山西矿业学院　大同矿务局　著

大同侏罗纪含煤地层沉积环境与聚煤特征

Sedimentary Environments and Coal Accumulation Features of Jurassic Measures in Datong

科学出版社

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内 容 简 介

本书系统地研究了大同侏罗纪含煤地层的沉积环境、聚煤特征和聚煤规律，对大同侏罗纪煤田的地质构造、地层、岩矿、古生物、古气候、煤层、煤质、地球化学等方面进行了深入的研究和分析。全书共分正篇和附篇两大部分，分别侧重于对大同组和永定庄组进行解剖和分析。书后附有大量的图版。

本书可供沉积学、煤田地质学科研人员和煤田勘探、开发生产人员参考。

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沉积环境与聚煤特征

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前　言

大同侏罗纪煤田是我国最大的动力煤产区之一，含煤地层分布大致呈NE—SW向。长47公里，宽20公里，总面积772平方公里，含煤地层总厚50—240米，一般为180—200米。可采煤层21层，总厚21米左右，含煤率9.5%，单层最大厚度可达7.81米。其煤质优良，硫分、灰分较低，发热量较高，是我国最大的优质动力用煤基地。

本煤田地质调查、开发历史悠久。1917—1939年先后有王竹泉、白家锦、翁文灏，日本人门仓三郎、森田日子次等对本区侏罗纪煤田进行过地质调查；1921年阎锡山首次开办大同煤矿；1939—1949年日本人为了进行掠夺性开采，同时在本区地层、煤层等方面做了一些调查和勘探，但研究程度较低。解放后，国家有计划地对大同煤田进行了系统勘探、开发和研究。截至1989年，共打钻孔2601个，提交各种普查、勘探报告89套，水文地质报告23套。现已有大型生产矿井14个，正在兴建的矿井1个，原煤产量已达3 000万吨/年，综合采煤机械化程度已达45.5%，所产煤炭畅销全国27个省、市、自治区。除满足国内市场需求外，目前正大量增加出口，远销日本、法国、英国、意大利、德国、澳大利亚和香港等20多个国家和地区。无疑，随着大同—秦皇岛铁路的修通，对外出口的数量和规模还会与日俱增。

在煤田勘探、开发过程中，中国科学院地质研究所、山西省区域地质调查大队、山西省115地质队、大同矿务局地测处等单位和陈庸勋、戴东林、斯行健、李星学、徐仁、胡希廉等学者先后对本区地层，古生物，沉积相，含煤地层的形成、发展，地质构造和伴生矿物等进行了不同程度的研究，提出了许多重要见解。但由于各种原因，尚未能对大同侏罗纪含煤地层沉积环境和聚煤规律进行全面系统的研究。

为了进一步认识本煤田的地质情况，更好地指导煤田今后的勘探和开发，从1986年6月起，山西矿业学院与大同矿务局合作，用3年多的时间，对本区沉积环境和聚煤特征开展了多方面的综合研究。工作过程中，我们在搜集原有资料的基础上，先后进行了为期半年的野外工作，实测地层剖面3条，实编钻孔地层柱状图3个；搜集以往钻孔地层柱状图2 000个，煤质数据35 000个；系统采集岩石标本610块，块煤标本31个，孢粉分析样197个，植物化石27种，双壳类化石30种；室内鉴定岩石薄片436个，粒度分析102个，差热分析及X射线衍射分析136个，微量元素和沉积磷酸盐分析147个，煤中微量元素分析13个，碳同位素分析(δC^{13})13个，鉴定块煤光片213个，粉煤光片61个，煤薄片27个，分析孢粉样76个。共鉴定出孢粉133属290种（其中新属5个，新种31个），古植物16属27种（其中新种2个），双壳类化石11属30种（其中新种1个）；获得了大批沉积构造、古流向分析数据和测井曲线资料，拍摄了数百张沉积构造、遗迹化石、岩矿、煤岩、孢粉和古生物化石照片，编制了100多幅各种类型的图表；另外还在苏朴同志配合下进行了古地磁和古纬度的测定。在充分运用这些资料的基础上，通过分析和研究，我们对大同侏罗纪含煤地层沉积环境和聚煤规律有了一个较系统的认识。现将研究结果汇编成册，公开出版。希望它能对大同煤田的进一步勘探、开发和研究有较好的参考价值，也希望它能对其它地区陆相含煤建造的研究有一定的启发和借鉴作用。

本课题的研究经费和地质勘探工作的原始资料主要由大同矿务局提供。

各章节的作者分别是：前言和摘要，贾炳文；第一章，王庆全、杨克用、王绥镇、李克、刘士斌、李建民；第二章，李克；第三章，贾炳文，武永强、王平泽；第四章，田士静，贺兴、李太任；第五章，王平泽、张玉三；第六章，李太任、田士静；第七章和结语，张玉三，李建民；第八章，张玉三；附篇，李克，贾炳文。

全部书的审定和统编工作由贾炳文、张玉三、李建民完成。

参加本课题研究工作的人员有，山西矿业学院贾炳文教授，张玉三、李太任、李克副教授和王平泽、武永强讲师；大同矿务局刘士斌、王庆全、李建民、田士静、贺兴、王绥镇、杨克用高级工程师。此外，山西矿业学院刘秀卿、张军营、吴养真、张小琴、陈红喜和大同矿务局冯月新、刘胜、聂秀英、张召弟、辛成华等同志在工作过程中参加了部分资料、图件的编制、清绘和样品测试分析工作。

参加本课题野外工作和部分室内分析鉴定工作的还有山西矿业学院煤勘专业82，83，84级部分学生。在全部工作过程中得到山西省115煤田地质勘探队，煤炭科学院西安煤田地质勘探分院，中国科学院原子能研究所，国家地震局地球物理研究所，山西省地质矿产局化验室，山西矿业学院地质系孢粉分析室、MPV-3型显微光度计室、光谱分析室、磨片室等单位和部门以及山西矿业学院苏朴副教授、大同煤炭工业学校郝临山讲师的大力支持，在此一并表示深切的谢意。

Brief Introduction

Jurassic coal field of Datong is one of the largest dynamic coal-producing area of China. With a total area of about 772km², the alignment of this coal-bearing basin is NE to SW, 47km long from NE to SW, and 20km wide from NW to SE. The strata of the coal measures are named as the Datong Formation, its total thickness is 50—240m. The extractive coal seams can be divided into 21 seams and their total thickness is up to 21m, coal-bearing rate is 9.5%, the biggest thickness of a single seam is up to 7.81m. The coal quality is very fine, containing very little sulfur and ash and being higher in calorific value limits.

This coal field has a long history of exploration and exploitation, but research degree was rather lower. After 1949, under the leadership of the Party and the people's goverment, further steps have been taken to exploite and study systematically and organically and greater progress has been made. In order to further develop the exploration and exploitation, in 1986, Shanxi Mining College cooperated with Datong Mining Bureau began to be engaged in scientific research of the sedimentary environment and coal accumulation features of Datong Jurassic coal field. Through hard work of more than three years, we have gathered many materials and much information and reached some new ideas. Now we have compiled them in a book form, and will publish it openly. We hope it will be of some reference and use in further exploration, exploitation and study in Datong coal field, and also hope it will have some inspiration and using for reference in the study of sedimentary environments and coal accumulation laws of other continental coal-bearing basins.

Through the study of this subject, we achieved some ideas as follows:

1. The study of biostratigraphy shows that the Datong Formation belongs to the Middle Jurassic. The study of spore-pollen is an important character of this subject. Besides common genera and species, there are 5 new genera nov. and 31 new species nov. discovered. The results study on spore-pollen not only play a significant part in identifying geological age of the Datong Formation, but also provide an important clue

to find out palaeoclimate and coal-forming plants. The study results indicate that palaeo-plants of the Datong Formation consist mainly of Gymnospermae and Pteridophyta, the analysis of palaeo-plant assemblages demonstrates that palaeoclimate of the Datong Formation can be classified into three periods: earlier, middle and later. During the earlier and later periods it was wet and hot, belonging to the tropics or subtropics climate (species of Pteridophyta being more and mixed). During the middle period, the climate had a tendency from a little warm to getting dry (species of Pteridophyta being less and pure). As a whole, the depositional time of the Datong Formation belongs to tropical-subtropical climate , being located to the south of latitude 30°N.

2. The study of petrology and sedimentology is a basis for analyzing depositional environments. Based on aboundant data of analysis and identification abtained from field and laboratory, the litho-sequences, sedimentary structures, lithologic features, grainsize distribitions, heavy minerals, clay minerals, trace elements, palaeoclimate, palaeocurrent logging curves and so on have been analyzed and discussed in great detail, all of these play an important part in searching for material source areas, identifying property of depositional medium and dynamic conditions of water, inferring the palaeoclimate and judging depositional environments of the Datong Formation.

3. Analysis of sedimentary environment is one of the contents for which we studied. According to the data collected, the Datong Formation can be considered as continental coal-bearing measures. The main sedimentary environment is as follows: river, lake-delta, lake and swamp, further, it can be divided into 14 sub-environments. According to the rock features lithofacies assemblage and characters of coal seams, the Datong Formation can be classified into three cycles from bottom to top, that is K_{11} sandstone——No.11 coal seam, No. 11—No. 4 coal seam, No. 4—K_{21} sandstone. The lower cycle, taking the fluvial facies as dominant deposits, coal seams is forked and merged frequently. The middle cycle takes lake-delta facies and lake-beach faicies as dominant deposits, the stability of coal seams is very good, a single coal seam appears commonly and phenomenon of forked and merged in coal seam is very few. The upper cycle is mainly lake-delta facies, there is forked and merged phenomenon in the coal seam. By analyzing the sandstone bodies and measuring the palaeocurrent, the result shows that the palaeocurrent of Dalong Formation is from NE to SW trend.

4. The study of coal seam, coal petrology and coal quality is another

main content of this subject. As to the distribution and correlation we take advantage of more than 2000 bore hole data, drawn up 158 correlation profiles and isopach maps of main extractive coal seams, and made uniform numbers to all coal seams from top to bottom. They are No. 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 15. The results of coal seam correlation were confirmed constantly in pits.

The synthetical study of coal petrology and coal chemistry indicates that coal petrologic components of Datong Formation consist mainly of inert constituent, such as fusinite-rich, semi-vitrinite and so on, its ground mass contains a great deal of fragments with inert components, enrichment of inert constituents make caking capacity of Datong coal decrease greatly. According to the indicators of coal petrology and coal chemistry, Datong coal can be divided into four coal facies, namely shallow water covered marsh poorly drained facies, shallow water covered marsh of flowing water facies, variable shallow water-covered marsh facies and dry marsh facies. The crosswise variation of coal facies are linked to sub-evironment which coal seam formed. Datong coal consists mainly of weakly caking coal, non-caking coal, partly of 1/2 medium caking coal and 1/3 coking coal. The type of coal-petrology directly affects the variation of coal quality. Subenvironment when coal series deposits and coal facies controlled components of coal petrology. The study result of coal-petrology and coal chemistry provide the basis for forecasting coal quality and for enlarging the utilization in industry of Datong coal.

5. The analysis of controlling coal factors indicates that coal accumulation feature and evolution of coal-rich zone in time and space are controlled by palaeotectonic and palaeo environment. Palaeotectonic controlled deposit rate of coal accumulation depressions as well as the extension and the shrinkage of coal-accumulation area, the intensity of tectonic movement and its zone-dividing crosswise and district-dividing vertically, resulting in variation and evolution of orignal depositional environment, still further, tectonic movement control the location and extension of coal-rich zone.

The crust activity is intensive relatively and the depositional environment change largely during the deposits of lower coal measures of Datong Formation, so the coal seam forked and merged frequently, the coal-rich zone located in the district where the subsidence is comparatively small and the swamp is comparatively stable, its general trend is nearly NESW, in accordance with the extension of thick coal measures. During

the deposits of middle coal measures, the crust is in comparative steadness period, so the coal seam is relatively stable and forked and merged phenomena in coal seam is not clear. During the deposits of upper coal measures, the crust activity is intensive again and the type of depositional environment is various again so the coal seams are forked and merged frequently again.

6. Correlation of regional data indicates that Datong coal field is probably not a sole original coal accumulation basin. It is infered that there was a large coal accumulation basin located in the northwest of North China at that time, which possibly at least concluded present three coal fields, that is, Datong, Ningwu and Erdous coal basin. The principal basis is that the three coal basins possess the same geologic age, common background of paleogeography and close relation of lithofeature, leathofacies, coal-bearing property as well as depositional cycle. Through analysis of the thickness of strata and lithofacies, it is shows that Datong coal field was located in the margin of the north-east part of this large coal accumulation basin.

7. In the course of this work, we have made some preliminary study for the strata, the sporepollen assemblage, geological age, palaeoclimate, and depsitional environment of Yongdingzhuang Formation underlying Datong Formation. We have also put forward some new ideas, together with descriptions of animal-plant as well as spore-pollen fossils, compiling them in appendix of this book for reference of vast numbers of readers.

Through the study of this subject, we consider that the practical significance is as follows:

1. According to the detailed study of mineral compositions, textures and structures of all rocks in Datong Formation, it will be offered reliable petrological basis to classify rock type of top-bed of coal seams and to manage them correctly in production of mining.

2. Through the analysis of depositional environment, an important direction will be given in infering variation of top-bed of coal seams, specially, in infering wash zone of top-bed of coal seams which affect comprehensive mining work seriously and arranging reasonally work plane of integrated mechanized coal getting.

3. The study of coal accumulation law and analysis of coal-controlling factors shows the direction of coal-rich zone and forked and merged of coal seams, it will play an active part in classifying mining area, making a good job of mining design and arranging the work plane of

integrated mechanized coal getting.

4. The synthetical study of coal petrology and coal chemistry will provide a basis for forecasting coal quality and making use of Datong coal reasonably.

5. The analysis of depositional environment and coal accumulation shows that the dividing and correlation of coal seams and coal series is reasonable, it will play a promotion role in further making exploration work and making good job of geological management of pits.

6. The correlation of regional geological data shows that the original Datong coal basin was larger than that of present time probably, so we can infer that there may be Jurassic coal measures underlying Cretaceous strata in the west of Datong coal field.

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第一节 地质调查和开发简史

一、地质调查简史

本区的地质调查工作是本世纪初开始的。1917年，地质学家王竹泉首次对大同侏罗纪煤田进行了地质调查，编写了地质报告。调查储量为96亿吨。1918年，宝晋公司矿师白象锦对矿区进行过勘察，主要在忻州窑、千金峪、马营涧等地，划定了12个井田。1921年，阎锡山与英办开滦煤矿公司合办的大同煤矿进行过局部勘探。1922年，日本人门仓三郎在局部调查后，也编写过地质报告。1924年，大同军人煤厂在口泉一带钻探11处。1929年，地质学家翁文灏与胡博渊又对煤田进行过调查，调查储量为105亿吨。1939—1943年间，晋北煤矿矿务局、日本人森田日子次等，再次对煤田作过程度不同的地质调查、地质测量和钻探，特别是森田日子次曾完成一万分之一地形图525平方公里，并在云岗、口泉等地钻孔10余个，著有《大同煤田之研究》，对部分煤田作过初步评价。

新中国成立后，政府开始有计划、有步骤地对煤田进行了大规模的调查和勘探。1952年组建了大同矿务局钻探公司，先后有国家地质调查所、115煤田勘探队、大同矿务局地测处、山西矿业学院、河北地质学院等参与煤田的研究工作，特别是大同矿务局地测处、115煤田勘探队成绩卓著，1972—1982年，先后提交了矿井、矿区精查报告7件，编绘了整体地质图件、资料和表册。矿务局地测处对口泉沟和云岗沟的煤岩层进行了对比，统一了各个煤层层位的标定。截至1989年，大同侏罗纪煤田地面钻孔共达2 601个，总进尺774 695米，勘探面积772平方公里，提交普查、详查、精查地质报告和矿井补充勘探报告49套，水文地质报告23套以及其它资料，为进一步综合研究和合理开发打下了扎实的基础。

二、开发简史

大同煤田开采历史久远，早在公元400年前后就有土法开采。1840年前后，当地农民利用农闲时节采煤，人数最多时可达500余人，但还没有专业矿工。1910年后，国内外商人兴建了忻州窑矿井，并铺设轻便铁路，由保晋公司经营。以后相继又出现了同宝、宝恒等采矿公司和一些私人名义的划片矿区，1924年前后，这种矿区由四五十处发展到198处，雇工2 400余人，最高年产量7—8万吨。1929年5月，晋北矿务局成立，购机器、扩建筑，开凿煤峪口和永定庄两处矿井，同时修建口泉至该矿井的专用铁路线。1929—1935年间的总产量达1 145 907吨，年产20—30万吨，职工总数近4 000人。1932年组成大同煤业公司，在“分采合销”协议执行中，大同煤炭销往国内外，促进了矿井的建设和近代资本主义采矿企业的发展。1936年矿区职工达8 000人之多。

1937年，日本帝国主义侵占大同。为了大规模掠夺煤炭资源，1942年组建“大同炭矿株式会社”，在永定庄、煤峪口、同家梁、白洞、四老沟、白土窑、鹅毛口、雁崖等地（见图1-1）

开凿新井和修建铁路专线。至此，各矿改为电力开采。日寇占领期间，总产量达1 170万吨。

1945年 8 月，抗战胜利后由国民党政府接收，恢复晋北矿务局，由于销售不畅，交通条件差，几个重要煤矿又变成人工开采，日产量为450—900吨，基本上处于半停产状态。

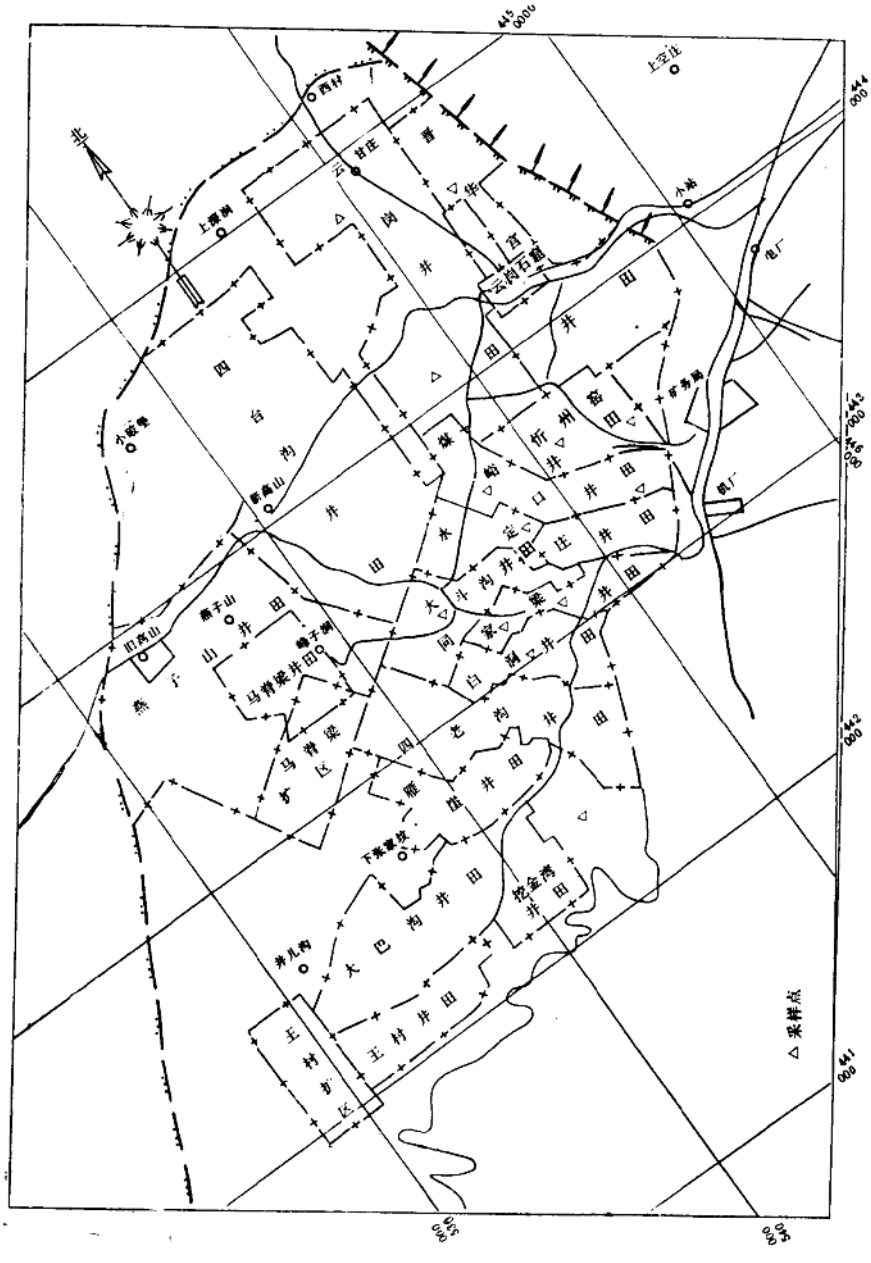

图1 1 大同矿务局井田分布图